Central Himálayas, occurred after the deposition of the sandstones which overlie the *nummulitics* of Húndés, and which are probably of miocene age. A considerable gap seems to exist between the latter and the ossiferous younger tertiaries which fill the Húndés basin.

There is clear evidence, therefore, of very early disturbances having taken place in the Himálayan area. There are abundant proofs that minor changes in the distribution of land and water have occurred not only frequently, but we can scarcely believe otherwise than that the forces which have resulted in the intricate folding and crumpling of the great sequence of sedimentary and crystalline strata must have been of very long duration, and were probably existent from the very earliest date when the first grain of sediment was deposited in the Himálayan seas. We can go further. Whatever other—and as yet only dimly understood—forces were at work to produce this contraction and folding of the earth's crust, we know of two forces about which there can scarcely be the slightest doubt. The first is the gradual cooling of our earth, and consequent lessening and shrinking of the surface of it. Secondly—and this is a force which may be mathematically expressed—we know that the centrifugal force endeavours to move every point on the surface of the earth in a direction opposite to that in which gravitation attracts it.

The actual force exerted is the resultant between the centrifugal and tangential forces, and it has the tendency, if I may so express it, of gradually moving each point on the surface of the earth towards the equator. It may be supposed that an enormous sequence, of to a certain extent pliable deposits, trying to move bodily, as it were, towards the equator, but *en route* arrested and banked up against a rigid mass of which the peninsula of India is a small remnant only, must necessarily have suffered wrinkling, and lateral crushing.

These forces operated since the earth existed, and must be active now. But throughout the great sequence of the palæozoic, mesozoic, and kainozoic deposits, we search in vain for an internal explanation of the great unconformities and disturbances of coast-line which have taken place at certain intervals, such as I have sketched out above. That these changes were not local overlaps only is apparent when we compare the Central Himálayan area with the Perso-Áfghán region. In the latter the physical changes are far more clearly marked. At the close of the carboniferous epoch, which was one of pelagic conditions in the Hindu Kúsh area, Khorassán and Persia, the distribution of land and water must have considerably changed, as we find immediately above the carboniferous limestone, shaly beds with coal-seams, and conglomerates and partly littoral, partly freshwater conditions prevailed in that area till late into jurassic times. These disturbances, which are slightly indicated in the Himálayas, are clearly shown and occur on a larger scale in the West Central Asian area.

The next great change in the Perso-Afghán area is the great overlap of the upper cretaceous (hippuritic) limestone over the neocomian, already alluded to. It has resulted in a great and often strongly expressed unconformity. Again, another and strongly marked change occurs in the middle tertiaries of the Perso-Áfghán area. The purely marine miocene beds are overlaid, often with isoclinal bedding, at other localities distinctly unconformably, by upper tertiary freshwater deposits. If the folding and crushing process were alone the cause of these—shall I call them cycles of disturbances—then at least some evidence of it should be observable within the sequences of rocks as we see them.

On the other hand, there is no direct evidence to show that the raising of the Himálayas as a mountain system was in any way due to these periodical fluctuations of sea-level, or, as Suess terms it, the "positive" and "negative" movements of the liquid covering of the earth. The evidence of the transverse valleys in the Himálayas points even to the probability that the raising up of the chains of hills forming them, *i.e.* the folding and crumpling of its rock strata, must have kept pace, step by step, with the erosion by rivers which we now find traversing the whole width of this mountain system.

Such transverse valleys, however, can only date since the last of the periodical changes spoken of, *i.e.* since the middle tertiary epoch. Before that time, up to the point when the last marine tertiary deposits were laid down along the margin of the Himálayas, the relative position of Peninsular India and Central Asia must have been the reverse of what we know them to be now; that is to say, the surface of the Central Asian elevated *massif* must have been nearer the centre of our earth than the surface of the continent, of which the Peninsula of India forms only a portion of the remains.

It is improbable that the folding action alone has been the cause of the present structure and orographical features of Central Asia and the areas south of it: for the final great changes which have resulted in the draining of Central Asia of the tertiary seas, of which nothing now remains but isolated salt-water lake-basins, such as the Aral and the Caspian are, we must look for other causes.

Possibly such may be found in the sinking in of large portions of the southern hemisphere which caused the submergence of the Indo-African area below what is now the Indian Ocean. With it the part now known to us as the Peninsula of India may have partially broken down, though of that we have no direct evidence, unless the improbability that the Central Asian area could have been pushed up to its present elevation above the Peninsula entirely through being folded might be adduced as proof. Large tracts of Central Asia we know could never have suffered folding to any but very slight extent, as, for instance, the greater part of the tertiaries of the Turkistán region which are often in undisturbed horizontal position. On the other hand, these latter are but little raised above—some are even depressed below—the level of India.

In all these considerations and speculations two points seem probable almost beyond doubt, namely: First, that the last and main disturbance of physical conditions of the Central Asian area has taken place in post eocene, perhaps in middle tertiary times, and is most likely still continued to the present day.[1] Secondly, that this period of disturbance coincides with the sinking in of the Indo-African continent, which "breaking down" caused the final draining of the tertiary seas from the Central Asian area.

Not so certain is whether the raising *en bloc* of the Central Asian mass above the level of the Indian Peninsula is due only to the folding process, or whether some movement downwards of the Peninsula, in connection with the sinking in of the Indo-African region, may not have had a share in producing the present configuration of the Húndés plateau. Some such movement may be conjectured. Certain supposed elevations of the Peninsula may possibly be owing to "negative" movements of the area of the Indian Ocean—in other words, to the sinking in of the ocean bed.[2]

SCIENTIFIC SERIALS.

American Journal of Science, January.—Theory of an interglacial submergence in England, by G. Frederick Wright. The theory of deep interglacial submergence which has been propounded to account for the shell-beds at Moel Tryfaen, near Snowdon, and at Macclesfield, is opposed by several formidable objections, viz. (1) the subsidence must have been one which affected North Wales and central England without affecting the region south of the the Thames and Bristol Channel; (2) there is in other places a considerable absence of marks of subsidence over the northern part of the centre of England, where it is supposed to have been the greatest; (3) the Pennine Chain is not more than 25 or 30 miles wide from east to west, yet east of Macclesfield there is an entire absence upon its flanks both of glacial deposits and of beach lines; (4) the shell beds are strictly confined not only to the area which was demonstrably covered by glacial ice, but to those more limited areas which were reached by ice that is known to have moved in its way over shallow sea-bottoms; (5) the assemblage of shells is not such as could have occurred in one place in the ordinary course of nature. The author develops a system of glaciers which will explain the facts at present known, upon the supposition of a single glacial epoch.—The Permian of Texas, by Ralph S. Tarr. It is shown that the Permian of Texas is, like other areas of Permian, a deposit in large measure made in an inland sea.—The chemical composition of iolite, by O. C. Farrington. The formula obtained from two analyses of exceptionally pure specimens of the mineral is $H_2O \quad 4(MgFe)O \quad 4Al_2O_3 10SiO_2$, the ratio of MgO to FeO in the two cases being as 7 : 2.—On a series of cæsium trihalides, by H. L. Wells; including their crystallography, by S. L. Penfield. Upon adding bromine to a concentrated solution of cæsium chloride, a bright yellow precipitate was obtained, from which crystals were formed having the composition $Cs.Cl.Br_2$. An attempt has been made to

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[1] "Manual," pp. lvi., 680, &c.

[2] *See* "Manual," p. 681.

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prepare all the members in the following series, and, with the exception of Nos. 4 and 10, all of them have been isolated: (1) CsI_3, (2) $CsBrI_2$, (3) $CsBr_2I$, (4) $CsClI_2$, (5) $CsClBrI$, (6) $CsCl_2I$, (7) $CsBr_3$, (8) $CsClBr_2$, (9) $CsCl_2Br$, (10) $CsCl_3$. The characteristics of these compounds have been fully studied.—The law of elastic lengthening, by J. O. Thompson. The author has made an extended and thorough investigation on Hooke's law. The experiments were carried out at the Physical Institute of the University of Strassburg, with the advice and help of Prof. Kohlrausch. They lead to the following conclusions:—(1) The generally accepted law of elastic lengthening, $x = \alpha P$, according to which the lengthening x is proportional to the stretching weight P is only an approximation. (2) The relation between elastic extension and stretching weight can be expressed by an equation of the following form:—

$$\chi = \alpha P + \beta P^2 + \gamma P^3.$$

(3) The modulus of elasticity of the undeformed body can be calculated with the help of the equation

$$\left(\frac{d\chi}{dP}\right)_{P=0} = d.$$

(4) The true moduli of elasticity, calculated in this way, may be as much as 16 per cent. larger than those determined in the ordinary way. Consequently it will be necessary to recalculate physical constants which depend on the modulus of elasticity.—A method for the quantitative separation of strontium from calcium by the action of amyl alcohol on the nitrates, by P. E. Browning.—The relation of melting-point to pressure in case of igneous rock fusion, by C. Barus. From the experiments on diabase the relation of melting-point to pressure at 1200° is $dT/dp = \cdot 021$; at 1100°, $dT/dp = \cdot 029$. And since the probable *silicate* value of $dT/dp = \cdot 25$ at 1170°, and as this falls within the margin (·020 to ·030) of corresponding data for organic substances such as spermaceti, paraffin, &c., it is inferred that the relation of melting-point to pressure, in case of the normal type of fusion, is nearly constant, irrespective of the substance operated upon.—The discovery of Clymenia in the fauna of the Intumescens zone (Naples beds) of Western New York, and its geological significance, by John M. Clarke.—A new meteoric iron from Garrett Co., Maryland, by A. E. Foote. A plate accompanies this paper.—Farrington, Washington Co., Kansas, aërolite, by G. F. Kunz and E. Weinschenk.—The skull of Torosaurus, by O. C. Marsh.

SOCIETIES AND ACADEMIES.

London.

Royal Society, January 21.—"Additional Observations on the Development of *Apteryx*." By T. Jeffery Parker, B.Sc., F.R.S.

The paper is founded upon the study of three embryos of *Apteryx australis* obtained since the author's former communication on this subject was written.

The youngest (stage E′) is intermediate between E and F of the former paper, the next (F′) between F and G, the most advanced (G′) between G and H.

In E′ the characteristic form of the beak has already appeared.

In F′ the pollex is unusually large, giving the fore-limb the normal characteristics of an embryo wing.

Several important additions and corrections are made to the former account of the skull, especially with regard to the presphenoid region, the basi-cranial fontanelles, and the relations between the trabecular and para-chordal regions.

The account of the shoulder-girdle is amended. In *Apteryx oweni* the coracoid region is solid, and no pro-coracoid appears ever to be formed: in *A. australis* a ligamentous pro-coracoid is present at a comparatively early period (stage F′, and perhaps E).

An intermedium is present in the carpus in all three specimens, in addition to the elements previously described.

The brain in stage G′ is interesting, as being at what may be called the critical stage; the cerebellum is fully developed, and the optic lobes have attained the maximum proportional size and are lateral in position. In all essential respects the brain of this embryo is typically avian.

Royal Microscopical Society, January 20.—Dr. R. Braithwaite, President, in the chair.—The Society adjourned after passing a vote of sympathy and condolence to His Royal Highness the Prince of Wales (Patron of the Society) on the sad loss he had sustained.—This being the annual meeting, the President's address, which was to have been read, was therefore postponed till the next meeting, February 17.

Edinburgh.

Royal Society, January 4.—Prof. Sir W. Turner, Vice-President, in the chair.—Dr. Noel Paton read a paper on the action of the auriculo-ventricular valves. It has hitherto been supposed that, when these valves close, the two flaps are floated up by the fluid, and, partially overlapping, prevent the passage of the fluid by being pressed against each other. Thus it has been supposed that, when closed, the upper surface of one flap presses against the under surface of the other. Dr. Paton has found, by direct experiment, that the flaps remain, on the whole, in a pendant position, the upper surfaces of the two being pressed together.—Mr. John Aitken read the second part of a paper on the number of dust particles in the atmosphere of certain places in Great Britain and on the Continent, with remarks on the relation between the amount of dust and meteorological phenomena.—Dr. Thomas Muir read a paper on a theorem regarding a series of convergents to the roots of a number. The investigation was suggested by some work of the late Dr. Sang. The series does not converge rapidly, and so cannot be of great practical use.—Mr. Malcolm Laurie read a paper on the development of the lung-books of *Scorpio*, and the relation of the lung-books to the gills of aquatic forms. He was led to investigate this subject by observations made on the allied fossil forms described in his paper read at the previous meeting of the Society. He concludes that the lung-books are not formed by a process of invagination, as is usually supposed to be the case. He considers that the cavities are formed by the growth of a protecting plate which finally adheres to the body.

Sydney.

Royal Society of New South Wales, November 4, 1891.—H. C. Russell, F.R.S., President, in the chair.—The following papers were read:—Notes on Artesian water in New South Wales, by Prof. David.—On the constitution of the sugar series, by W. M. Hamlet.

December 2.—H. C. Russell, F.R.S., President, in the chair.—The following papers were read:—On kaolinite from the Hawkesbury sandstone, by H. G. Smith.—Notes on some New South Wales minerals (Note No. 6), by Prof. Liversidge, F.R.S.—Notes on the rate of growth of some Australian trees, by H. C. Russell, F.R.S.—Some folk-songs and myths from Samoa, translated by the Rev. G. Pratt, with introductions and notes, by Dr. John Fraser.

Paris.

Academy of Sciences, January 18.—M. Duchartre in the chair.—Obituary notice on the late Sir George Biddell Airy, by M. Faye.—On the mass of the atmosphere, by M. Mascart. It is shown that the determination of the mass of the atmosphere by observations of the pressures at the surface is open to serious objections, and involves a notable error. The mass, calculated by means of the formulæ developed by M. Mascart, is one-sixth greater than that usually obtained. The quantity of air situated at a height of 64 kilometres is 1/700 of the total mass. Particles of ice and water are suspended at this height, although the air is so rarefied. It is therefore presumed that the density does not diminish uniformly with increase of height above sea-level, but decreases more slowly in high than in low strata. [On this point see a note in Nature, p. 259.]—New note on the resistance and small deformations of helical springs, by M. H. Resal.—On solar statistics for 1891, by M. Rodolf Wolf. (See Our Astronomical Column.)—Observations of Wolf's periodic comet, made in 1891 with the great equatorial of Bordeaux Observatory, by MM. G. Rayet, L. Picart, and Courty. Observations of position are given, extending from June 27 to December 27.—On integrals of differential equations of the first order, possessing a limited number of values, by M. P. Painlevé.—On an arithmetical theorem of M. Poincaré's, by M. Victor Stanievitch.—On organic compounds as solvents for salts, by M. A. Etard.—Action of carbon monoxide on iron and manganese, by M.

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